Electrical and Mechanical Systems Safety Branch

RJ Matetic, Ph.D.
Branch Chief
Mission

• Reduce traumatic injuries in the mining workplace through new electrical and machine safety interventions and improved lighting

• Increase the effectiveness of mine emergency and disaster response through new mine communications and tracking systems and design guidelines

• Improve the safety and survivability of mine communications and tracking systems
## Branch Structure/Staff

**Branch Chief:** RJ Matetic  
**Deputy:** Todd Ruff  
**POA:** Berni Sobeck

<table>
<thead>
<tr>
<th>Electrical Safety and Communications Team</th>
<th>Machine Safety Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joe Waynert (Team Leader)</td>
<td>Rich Unger (Team Leader)</td>
</tr>
<tr>
<td>9 Scientists/Engineers</td>
<td>10 Scientists/Engineers</td>
</tr>
<tr>
<td>4 Technicians</td>
<td>1 Technician</td>
</tr>
<tr>
<td></td>
<td>3 Interns</td>
</tr>
</tbody>
</table>
Facilities and Equipment

Joy 14CM mining machine

Human performance research mine and motion capture system

Mine illumination laboratory
Facilities and Equipment

Safety Research Coal Mine

Reardan, WA test facility

Communications system laboratories
## Research Portfolio

<table>
<thead>
<tr>
<th>Project</th>
<th>Project Officer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligent safety technologies for mining equipment</td>
<td>Jacob Carr</td>
</tr>
<tr>
<td>Underground mine illumination systems</td>
<td>John Sammarco</td>
</tr>
<tr>
<td>Communications &amp; tracking system modeling and performance</td>
<td>Joe Waynert</td>
</tr>
<tr>
<td>Analysis of mining electrical injuries</td>
<td>Gerry Homce</td>
</tr>
<tr>
<td>Battery safety enhancements for underground coal mines (proposed)</td>
<td>Tom Dubaniewicz</td>
</tr>
<tr>
<td>IEC certification of intrinsically safe handheld electronic equipment (proposed)</td>
<td>Mike Yenchek</td>
</tr>
</tbody>
</table>
Research Project

Intelligent Safety Technologies for Mining Equipment
Intelligent Safety Technologies for Mining Equipment

**Goal:** Investigate existing and emerging technologies to provide automatic, intelligent protection against injuries due to striking/pinning and unexpected machine startup.

**Tasks/Outputs:**

- **Intelligent Proximity Detection for Continuous Mining Machines**
  - Develop a system that tracks the location of multiple miners and disables any machine movement that would cause an accident
  - Develop an educational campaign for CMM operators to remove barriers to proximity detection system acceptance

- **Intelligent Lockout/Tagout (iLOTO)**
  - Develop electronic LOTO components that communicate over a mine-wide network to provide machine status information to management and maintenance personnel in order to prevent unexpected machine startup

**Partnership opportunities:** mine operators, equipment manufacturers, proximity detection and LOTO manufacturers
Intelligent Safety Technologies for Mining Equipment

Intelligent Proximity Detection System

- Position is continuously tracked
- Only the machine movements that would cause an injury are blocked - provides more reliable protection with fewer false alarms
Research Project

Underground Mine Illumination Systems for Improving Miner Visual Performance
Mine Illumination Systems for Improving Miner Visual Performance

Goal: Reduce traumatic injuries by developing mine illumination systems designed to improve a miner’s visual performance.

Tasks/Outputs:
• Develop a new cap lamp using Light Emitting Diode (LED) technology
• Develop a LED-based visual warning and indicator system for mobile mining equipment
• Commercialize new technology through partnerships
**Mine Illumination Systems for Improving Miner Visual Performance**

**NIOSH LED Visual Warning System**
- Reduced machine movement detection times (operators and other workers)
- Development status:
  - Cooperative research agreement with Northern Light Technologies
  - Intrinsic safety and explosion proof enclosure design contract awarded to Matric

**NIOSH LED cap lamp**
- Improvements over traditional cap lamps
  - Better peripheral motion and floor hazard detection times
  - Reduced power consumption
- Development status:
  - Commercialization partnership with EnerSys
  - Field worthy units ready for evaluation
Research Project

Communications & Tracking System Modeling and Performance
Communications & Tracking System Modeling & Performance

**Goal:** Provide design and implementation recommendations to improve underground mine communications and tracking system performance and mine rescue effectiveness.

**Tasks/Outputs:**

- Ultra-high Frequency (UHF) radio path-loss modeling and validation
- Medium Frequency (MF) communication system performance
- Through-the-Earth (TTE) communication system performance
  - Study the factors that control underground UHF, MF and TTE radio signal propagation in order to provide communication system design and installation recommendations and software design tools
- Tracking system improvements
  - Research methods to improve tracking system accuracy and performance and provide guidance for tracking system installation

**Partnership opportunities:** Mine operators – underground tests of communications and tracking systems, communications and tracking equipment manufacturers, research organizations and universities
Communications & Tracking  
System Modeling & Performance

Develop models and software tools to describe and predict radio signal propagation in mines

Validate these models through laboratory, surface and underground tests
Research Project

Analysis of Mining Electrical Injuries, 2000-2009
Analysis of Mining Electrical Injuries - Pilot

Goal: Identify current, specific electrical safety problems in the mining industry and develop future research plans.

Tasks/Outputs:
• Conduct a detailed analysis of MSHA electrical accident/injury data
• Prepare a report to be published by the end of 2011
• Prepare a research proposal for a new project to develop mine electrical injury interventions
Proposed Research Project

Battery Safety Enhancements for Underground Coal Mines
Battery Safety Enhancements for Underground Coal Mines

Goal: Determine risks associated with the use of batteries in underground coal mines and provide recommendations for safe usage, alternate chemistries, and future research.

Tasks/Outputs:
- Develop Lithium battery permissibility recommendations based on experimental ignition research
- Develop large-format battery protection enhancements and recommendations based on industry input
- Develop communications and tracking system battery recommendations based on contract studies

Potential Partners: Battery manufacturers, mining equipment manufacturers
Battery Safety Enhancements for Underground Coal Mines

NIOSH test chamber for battery crush tests in methane-air mixture

Chamber controller and analysis system
Proposed Research Project

IEC Certification of Intrinsically-Safe Handheld Electronic Equipment

Goal: Determine whether IEC IS certification will or will not compromise safety if applied to US mines and determine potential impact if accepted.

Tasks/Outputs:
• Compare and contrast IEC and MSHA IS certification requirements and processes
• Survey and quantify IEC and MSHA certified portable equipment and support services
• Determine if IEC approved devices were involved in any mine incidents (fires, explosions, etc.)
• Develop internal report on recommendations for the adoption of IEC IS standards

Partnership opportunities: Underwriters Laboratory, FM Global, MSHA
Past Partnership Efforts

- Communications and tracking system developers - 2006 MINER Act contracts
- Mine Emergency Communications Partnership
- CONSOL Energy
- ARCH Coal
- Patriot Coal
- Foundation Coal
- International Coal Group

communications/tracking system tests

- National Institute of Standards and Technology - underground radio communications research
- Northern Light Technologies - LED lighting systems
- EnerSys – LED cap lamp
Electrical and Mechanical Systems Safety Branch

Branch Chief: Dr. RJ Matetic
Contact info: (412) 386-6560  RMatetic@cdc.gov

The Office of Mine Safety and Health Research is a division of the National Institute for Occupational Safety and Health (NIOSH) www.cdc.gov/niosh/mining

NIOSH is a division of the Centers for Disease Control and Prevention within the Department of Health and Human Services www.hhs.gov